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FINAL TECHNICAL REPORT

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Grant Title: Radon Tracing of Biogenic Gas Fluxes from Coastal Wetlands and Tidal Freshwater Estuaries

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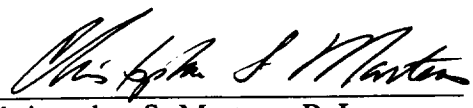

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INTRODUCTION

The research completed under NASA Grant NAGW - 1455 was focused on biogeochemical processes controlling the fluxes of biogenic gases to the troposphere from coastal wetlands and tidal freshwater estuarine environments. Production and transport processes controlling methane fluxes were emphasized. Primary tools utilized to determine the mechanisms and in situ rates of specific processes were the composition of gases, including stable C isotopic studies in collaboration with another project, and concentration distributions of the radioactive, inert gas, radon - 222.

Specific research goals of the work included:

i) utilization of radon - 222/radium - 226 disequilibrium to determine mechanisms and rates of gas fluxes from wetland soils and sediments, including plant transport,

ii) quantification of the role of gas bubble transport in methane fluxes to the atmosphere from wetland and estuarine environments,

iii) the combined use of bulk gas composition and methane stable isotopic composition to quantify microbial versus transport controls on net methane fluxes to the atmosphere,

iv) studies of the influence of organic matter source and reactivity on biogenic gas production and fluxes, and

v) determination of the influence of variations in water level innundation and soil moisture changes on gas fluxes from wetland soils.

Research was conducted at numerous wetland and estuarine field sites in North Carolina, in tundra environments of western Alaska, in boreal forest fens of northern Quebec, and in peatlands of northern Minnesota. In addition, we conducted studies of Amazon varzia and Everglades environments utilizing samples provided by others. In general, studies at the North Carolina sites focused on understanding key variables controlling seasonal variations in biogenic gas production and transport processes, whereas studies of the northern wetlands was focused on quantifying controls on biogenic gas composition and fluxes during the warm season.

The Alaskan and Canadian wetlands investigations were conducted under the auspices of the NASA ABLE 3A and ABLE 3B missions. We benefited tremendously from collaborations with other researchers involved in those missions as well as logistics support.

SUMMARY OF COMPLETED RESEARCH

Our research produced numerous data sets from all of the environments studied. These results have largely been published in eleven refereed journal articles, two theses and dissertations, and seventeen abstracts from papers presented orally at important national meetings and workshops. One additional paper is in preparation for publication as a refereed journal article. A list of the published refereed journal articles as well as thesis and dissertation titles follows. All of the articles properly acknowledge support from NASA grant NAGW - 1455

Refereed Journal or Book Articles: NASA Grant NAGW-1455

Martens, C. S. and J. P. Chanton, 1988. Radon-222 as a tracer of biogenic gas equilibration and transport from methane-saturated sediments. *J.Geophys.Res.-Atmospheres 94:* 3451-3459.

Chanton, J. P., P. M. Crill, K. B. Bartlett and C. S. Martens, 1989. Amazon capims (floating grassmats): A source of ^{13}C enriched methane to the troposphere. *Geophys. Res. Lett. 16*: 799-802.

Chanton, J. P., C. S. Martens and C. A. Kelley, 1989. Gas transport from methane-saturated, tidal freshwater and wetland sediments. *Limnol. Oceanogr. 34*: 807-819.

Kelley, C. A., C. S. Martens and J. P. Chanton, 1990. Variations in sedimentary carbon remineralization rates in the White Oak River Estuary, North Carolina. *Limnol. Oceanogr. 35*: 372-383.

Martens, C. S., 1992. Bacterial methane in organic-rich environments from the deep sea to high latitude tundra wetlands. *Proceedings of the Bacterial Gas Symposium*, Milan, Italy.

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Chanton, J. P., C. S. Martens, C. A. Kelley, P. M. Crill, and W. J. Showers, 1992. Methane transport mechanisms and isotopic fractionation in emergent macrophytes of an Alaskan tundra lake. *J. Geophys. Res.–Atmos. 97*: 16681-16688.

Kelley, C. A., N. Dise and C. S. Martens, 1992. Temporal variations in the stable carbon isotopic characterization of methane from Minnesota peatlands. *Global Biogeochemical Cycles 6*: 263-269.

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Ussler III, W., J. P. Chanton, C. A. Kelley and C. S. Martens, 1994. Radon 222 tracing of soil and forest canopy trace gas exchange in an open canopy boreal forest. *J. Geophys. Res. 99*: 1953-1963.

Kelley, C. A., C. S. Martens, and W. Ussler III, 1995. Methane dynamics across a tidally flooded riverbank margin. *Limnol. Oceanogr. 40:* 1112-1129.

Theses and Dissertations: NASA Grant NAGW-1455

Kelley, Cheryl A., 1988. Sedimentary Organic Carbon Remineralization Rates Along the Salinity gradient of the White Oak River Estuary, North Carolina. University of North Carolina at Chapel Hill, 109 pp.

Kelley, Cheryl A., 1993. Physical Controls on Methane Production and Flux from Organic-Rich Wetland Environments. University of North Carolina at Chapel Hill, 215 pp.